

What is claimed is:

5 1. A stage for precise linear motion of a workpiece in at least one dimension, said stage comprising:

 at least one hardened steel linear guideway for physical contact with a bearing,
said guideway comprising at least one flat surface having a thickness greater than about
10 100 microns and less than about 10 millimeters;

 a chassis comprising a material having a bulk density no greater than about 6 g/cc,
and having a specific stiffness at least 50 percent greater than that of said hardened steel
linear guideway, said chassis furthermore comprising at least one land for receiving and
15 supporting said guideway; and

 said guideway attached to said chassis at said land.

 2. The stage of claim 1, wherein said material of said chassis comprises a metal
20 matrix composite material.

 3. The stage of claim 2, wherein said metal matrix composite material comprises
silicon carbide distributed in a matrix comprising aluminum.

25 4. The stage of claim 1, wherein said guideway is attached to said chassis by at least one of soldering and brazing.

 5. The stage of claim 1, wherein said material of said chassis has a bulk density
no greater than about 5 g/cc, and said stage is for use in a semiconductor wirebonding
30 apparatus.

6. A macrocomposite gib, comprising:

at least two linear guideways arranged with respect to one another so as to define a bearing race, at least one of said linear guideways comprising a macrocomposite
5 guideway comprising (i) a hardened steel surface element adjacent said bearing race, and
(ii) a lightweight composite substrate adhered to and supporting said hardened steel surface element; and

at least one bearing element disposed in said bearing race.

10 7. The macrocomposite gib of claim 6, further comprising a means for preloading said at least one bearing element.

8. A macrocomposite linear guideway, comprising:

15 a substrate body comprising a composite material;

a hardened steel body comprising at least one surface to be in physical contact with a bearing, and at least one surface other than said physical contact surface, said at
20 least one other surface to be a bonding surface; and

a bond attaching said hardened steel body to said substrate body at said bonding surface.

25 9. The linear guideway of claim 8, wherein said composite material comprises a network structure comprising silicon carbide, and a phase comprising elemental or alloyed silicon distributed throughout said network structure.

30 10. The linear guideway of claim 8, wherein said composite material comprises at least one metal in elemental or alloyed form selected from the group consisting of aluminum, beryllium, magnesium and silicon.

11. The linear guideway of claim 8, wherein said hardened steel body comprises tool steel.

12. The linear guideway of claim 8, wherein said bond is realized by means of a solder.

13. The linear guideway of claim 8, wherein said composite material comprises at least one material selected from the group consisting of a ceramic matrix composite and a metal matrix composite.

14. The linear guideway of claim 13, wherein said metal matrix composite material comprises a ceramic particulate reinforced aluminum.

15. The linear guideway of claim 14, wherein said ceramic particulate comprises at least one material selected from the group consisting of silicon carbide, boron carbide, aluminum oxide and aluminum nitride.

16. A guideway for a bearing, comprising:

a hardened steel layer; and

a substrate attached to said hardened steel layer, said substrate comprising a material having a bulk density no greater than about 60 percent that of said hardened steel layer.

17. The guideway of claim 16, wherein said substrate comprises a composite material comprising at least one ceramic material.

18. The guideway of claim 16, wherein said substrate comprises a lightweight metal.

5 19. The guideway of claim 18, wherein said lightweight metal comprises beryllium.

20. The guideway of claim 18, wherein said lightweight metal comprises an alloy comprising beryllium and aluminum.

10 21. The guideway of claim 16, wherein said hardened steel layer comprises at least one surface intended to be in contact with a contact-type bearing, and wherein said at least one surface defines a linear path for travel of said bearing.

15 22. The guideway of claim 16, wherein said at least one surface defines a circular path for travel of said bearing.

23. The guideway of claim 16, wherein said substrate comprises at least one ceramic material selected from the group consisting of silicon carbide, boron carbide, aluminum nitride, silicon nitride, aluminum oxide and zirconium dioxide.

20 24. The guideway of claim 23, wherein said silicon carbide comprises reaction-formed silicon carbide.

25 25. The guideway of claim 16, wherein said hardened steel comprises tool steel.

26. The guideway of claim 16, wherein said substrate further has a specific stiffness at least 50 percent greater than that of said hardened steel.